6.5A High Power DC/DC Converter Controller IC

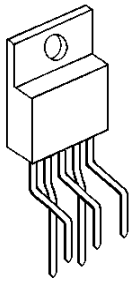
■GENERAL DESCRIPTION

The **NJM2399** is a high power step down DC/DC converter IC.

It incorporates 6.5A power transistor, ±2% accuracy precision voltage reference, fixed frequency PWM controller with cycle-by-cycle current limit and low power consumption stand by function.

The **NJM2399** realizes a high power step down application with minimal external components.

■PACKAGE OUTLINE



PIN FUNCTION
1:V_{FB}
2:SW_{OUT}
3:GND
4:V^+
5:STBY (V_{COMP})

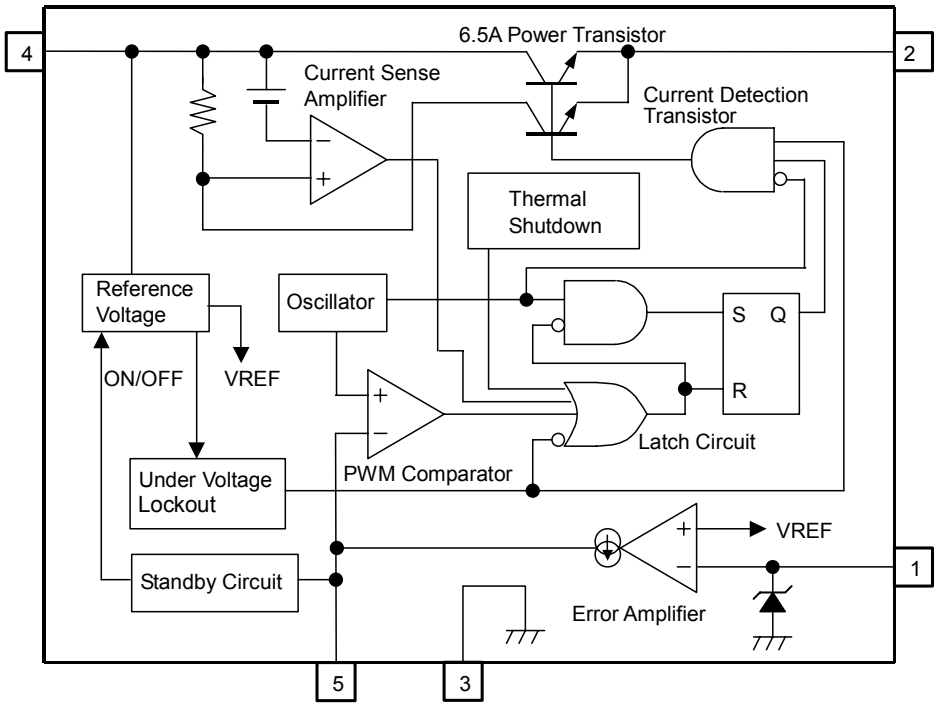
NJM2399TLA2050

Pin 1 locates on the left side of the package drawing (top front view).

■FEATURES

- Adjustable output voltage more than 5V
- Operating Voltage 7.5V to 40V
- PWM form Switching Power Supply Control
- Internal High Power Transistor 6.5A (min.)
- Fixed Frequency Oscillator 72kHz (typ.)
- Current Sense Amplifier
- Under Voltage Lockout
- Thermal Shutdown Circuit
- Bipolar Technology
- Package Outline TO-220(5PIN)

■BLOCK DIAGRAM



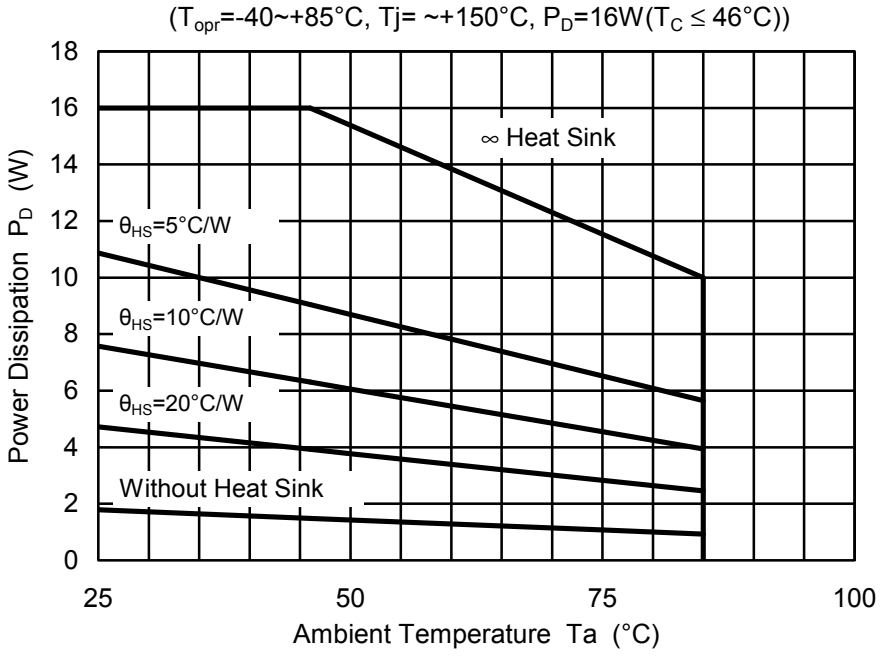
■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Maximum Supply Voltage	V^+	40	V
Switch Output Voltage	$Vo_{(SWITCH)}$	-0.5 ~ +Vin	V
Voltage Feedback and Compensation Input Voltage Range	V_{FB},V_{COMP}	-0.3 ~ +7.0	V
Power Dissipation	P_D	TO-220 (5PIN) 16($T_C \leq 46°C$)	W
Operating Junction Temperature	Tj	-40 ~ +150	°C
Operating Temperature Range	Topr	-40 ~ +85	°C
Storage Temperature Range	Tstg	-50 ~ +150	°C

■THERMAL CHARACTERISTICS

Thermal Resistance	Junction-to-Ambient Temperature	θja	70	°C/W
	Junction-to-Case	θjc	6.5	

■POWER DISSIPATION vs. AMBIENT TEMPERATURE



■ELECTRICAL CHARACTERISTICS (V^+=12V, Ta=25°C)

Oscillator Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Frequency	fosc	V^+=7.5V	65	72	79	kHz

Error Amplifier Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Feedback Input Threshold	V_{FB}(th)		4.9	5.0	5.1	V
Line Regulation	REG·Line	V^+=7.5 ~ 40V	–	0.03	0.08	%/V
Input Bias Current	I_B	V_{FB}=V_{FB}(th)+0.15V	–	0.15	1.0	μA
Ripple Rejection	PSRR	V^+=10 ~ 20V	–	80	–	dB
Output Voltage Swing	V_{OH} V_{OL}	Isource=75μA,V_{FB}=4.7V Isink=0.4mA,V_{FB}=5.3V	4.2 –	4.9 1.6	– 1.9	V V

PWM comparator Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Duty Cycle Maximum Minimum	 $DC_{(MAX)}$ $DC_{(MIN)}$	 V_{FB}=0V V_{FB}=5.3V	 – 0	 95 0	 – 0	 % %

Switch Output Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage Saturation	V_{SAT}	V^+=7.5V,Isource=6.5A	–	V^+-1.8	V^+-2.1	V
OFF-State Leakage	$Isw_{(off)}$	V^+=40V,SW_{OUT}=0V	–	0	100	μA
Current Limit Threshold	$Ipk_{(SWITCH)}$	V^+=7.5V	6.5	7.5	9.0	A
Switching Times Output Voltage Rise Time Output Voltage Fall Time	 tr tf	 V^+=40V,R_{OUT}=7.7Ω,V_{FB}=0V V^+=40V,R_{OUT}=7.7Ω,V_{FB}=0V	 – –	 100 50	 – –	 ns ns

Under Voltage Lockout Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Startup Threshold	$V_{TH(UVLO)}$	V^+ Increasing	5.9	6.3	6.7	V
Hysteresis	$V_{H(UVLO)}$	V^+ Decreasing	0.6	0.8	1.0	V

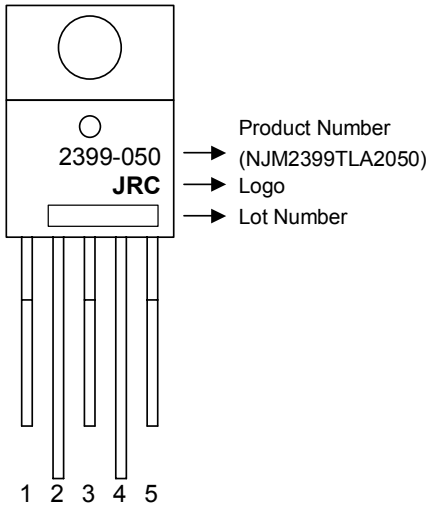
Total Device

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Standby-State Power Supply Current	$Icc_{(stby)}$	STBY≤0.1V	–	36	100	μA
Operating-State Power Supply Current	Icc	V^+=40V,V_{FB}=0V duty·cycle=MAX	–	40	53	mA

Keep the limit of maximum power dissipation not to operate thermal shutdown.

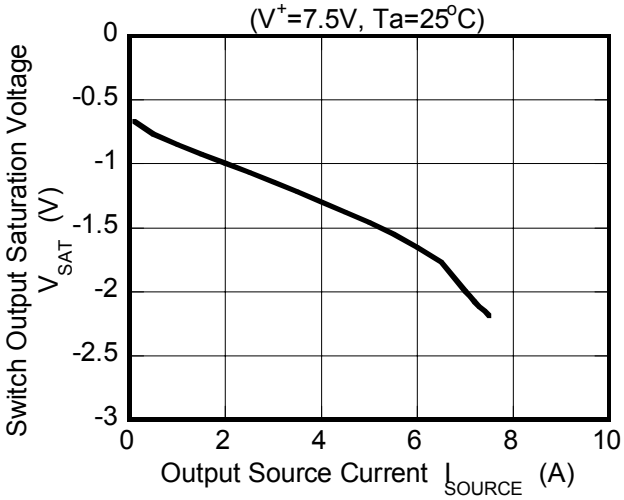
Low duty cycle pulse test is used to close its junction temperature to ambient temperature.

■MARKING

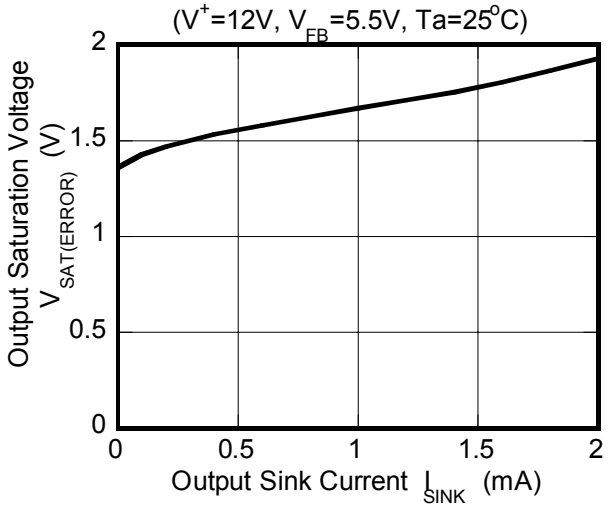


■TYPICAL CHARACTERISTICS

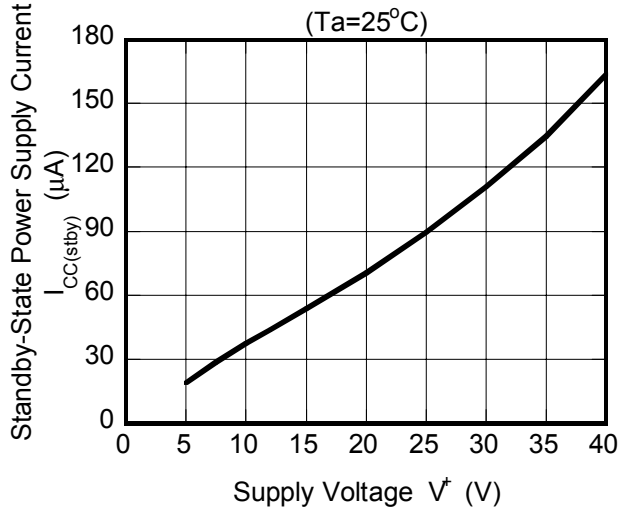
Switch Output Saturation Voltage vs. Output Source Current



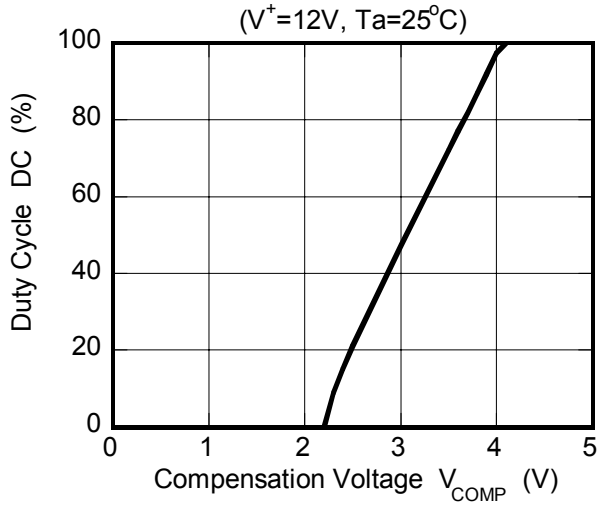
Error AMP Block Output Saturation Voltage vs. Output Sink Current



Standby-State Power Supply Current vs. Supply Voltage

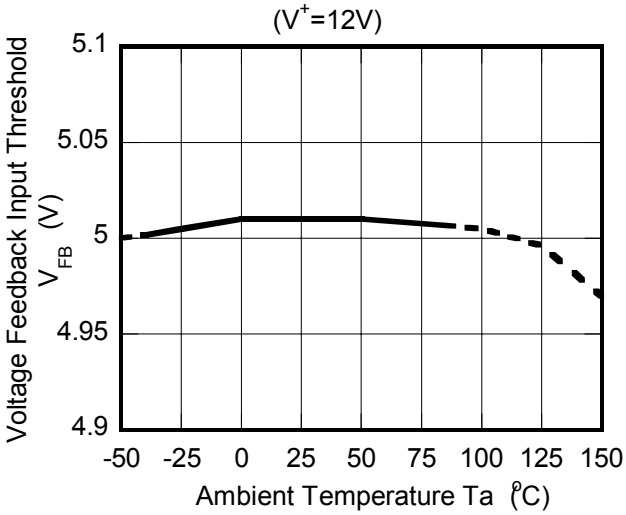


Duty Cycle vs. Compensation Voltage

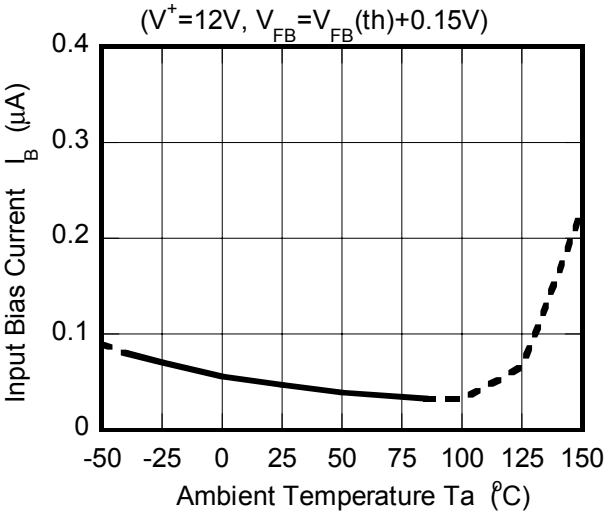


■TYPICAL CHARACTERISTICS

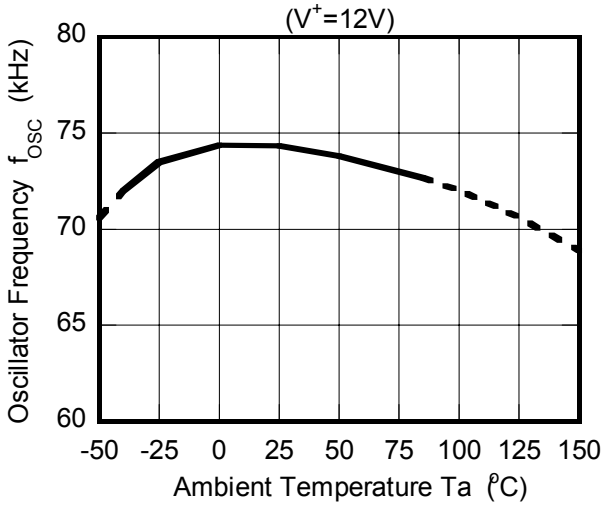
Voltage Feedback Input Threshold vs. Temperature



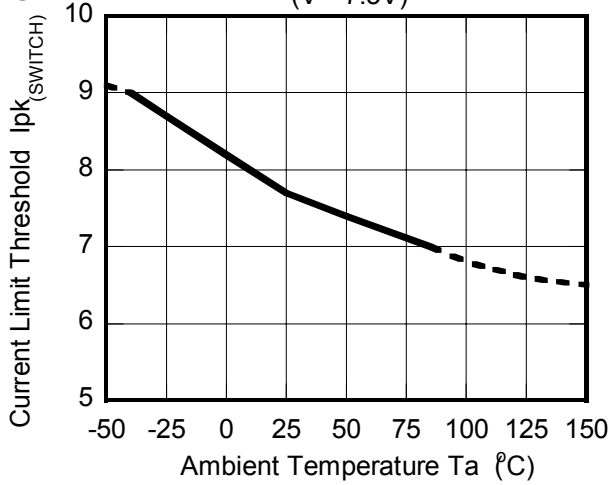
Error AMP Block Input Bias Current vs. Temperature



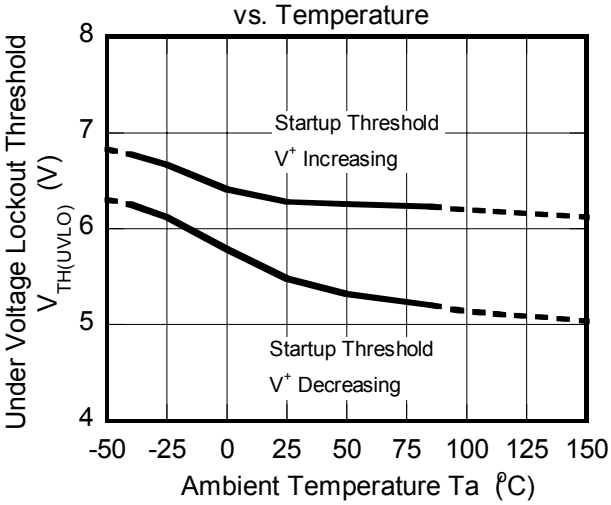
Oscillator Frequency vs. Temperature



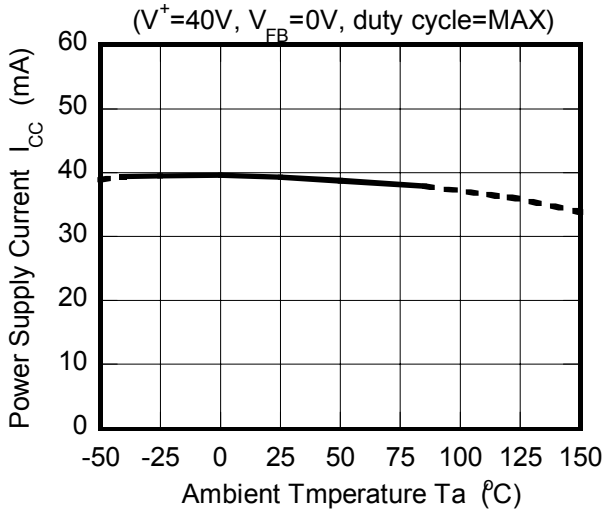
Current Limit Threshold vs. Temperature



Under Voltage Lockout Threshold vs. Temperature

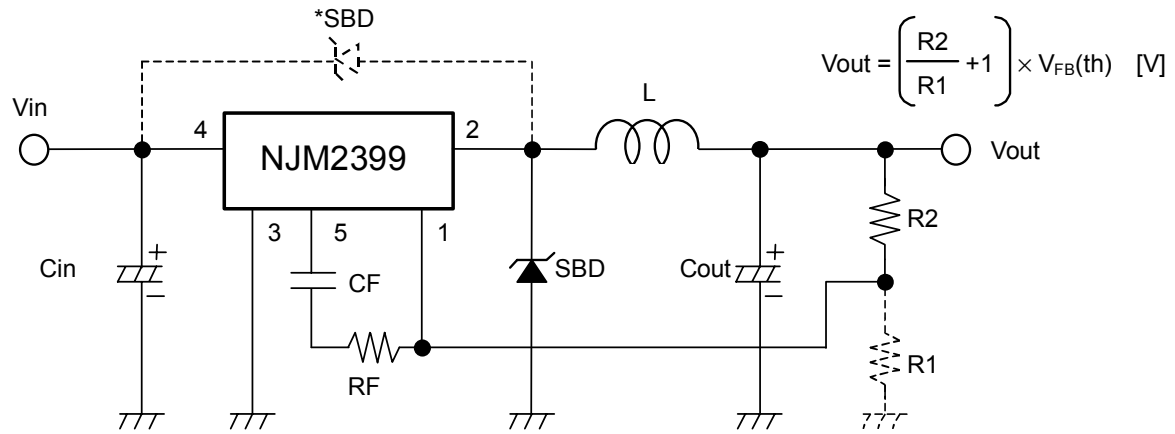


Operating-State Power Supply Current vs. Tmperature



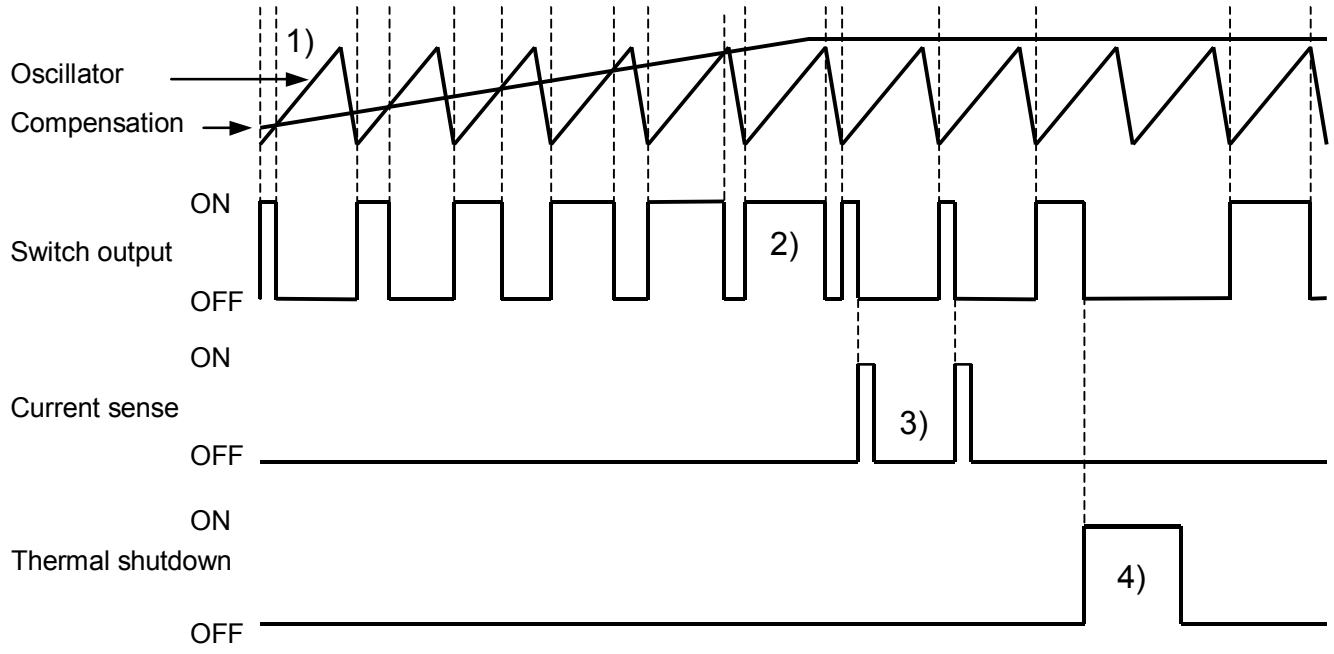
■ TYPICAL APPLICATIONS

Step-Down Converter



1) 5V and higher converter, the application must be connected R1 resistor according to above figure.
2) High current converter, the application must be placed Cin capacitor next to NJM2399, which avoid the power-line fluctuation.
3) The sharp fluctuation of output load cause reverse voltage for inductance and over the supply-voltage for SW_{OUT} terminal. To avoid this problem, the application must be placed SBD between terminal 2 and 4.

■ TIMING CHART



1) The NJM2399 generate square waves. The PWM comparator generate PWM signals to compare square waves and compensation voltage.
2) The switching duty is maximum 95%(typ.).
3) Over the 7.5A(typ.) current, the output switch will be OFF to operate current limit protection. The NJM2399 sense the switching current of power transistor.
4) Over the Tj=180°C(typ.), the switching will be OFF to operate thermal shutdown circuit.

MEMO